
Space Weather Technical Forecast

Issued on Thursday, 11 July 2024 at 13:08 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: M-class flares expected. Chance of G1 Minor Storms mainly day 3 (13 Jul).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: High with five M-class flares observed, peaking M1.4 at 10/1204 UTC from AR3738 in the south centre disc. This is largest and most complex of the nine sunspot regions on the disc, and despite losing its delta configuration within its intermediate region, and having some spreading of the leader and trailer, has seen ongoing slow growth with further small spots emerging within it. The other regions are all smaller and simpler, with the most complex being AR3743 in the southeast, however this maintains a simple bipolar structure.

No Earth-directed CMEs occurred, however a large asymmetric halo was observed in coronagraph imagery from off the far-side.

Solar Wind / Geomagnetic Activity: Slow wind conditions dominated with solar wind speeds observed by ACE easing from near 400km/s to be around background at 350-380km/s. Density was below average. Interplanetary Magnetic Field, Bt, was weak, below 6nT. The north-south component, Bz, varied weakly between +5/-5nT. Phi angle was mostly negative (toward the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background. High energy electron flux (greater than 2MeV) observed by GOES16 was at background. The 24-hour fluence was below Active, with 1.93e6 integrated pfu observed at 11/0000UTC.

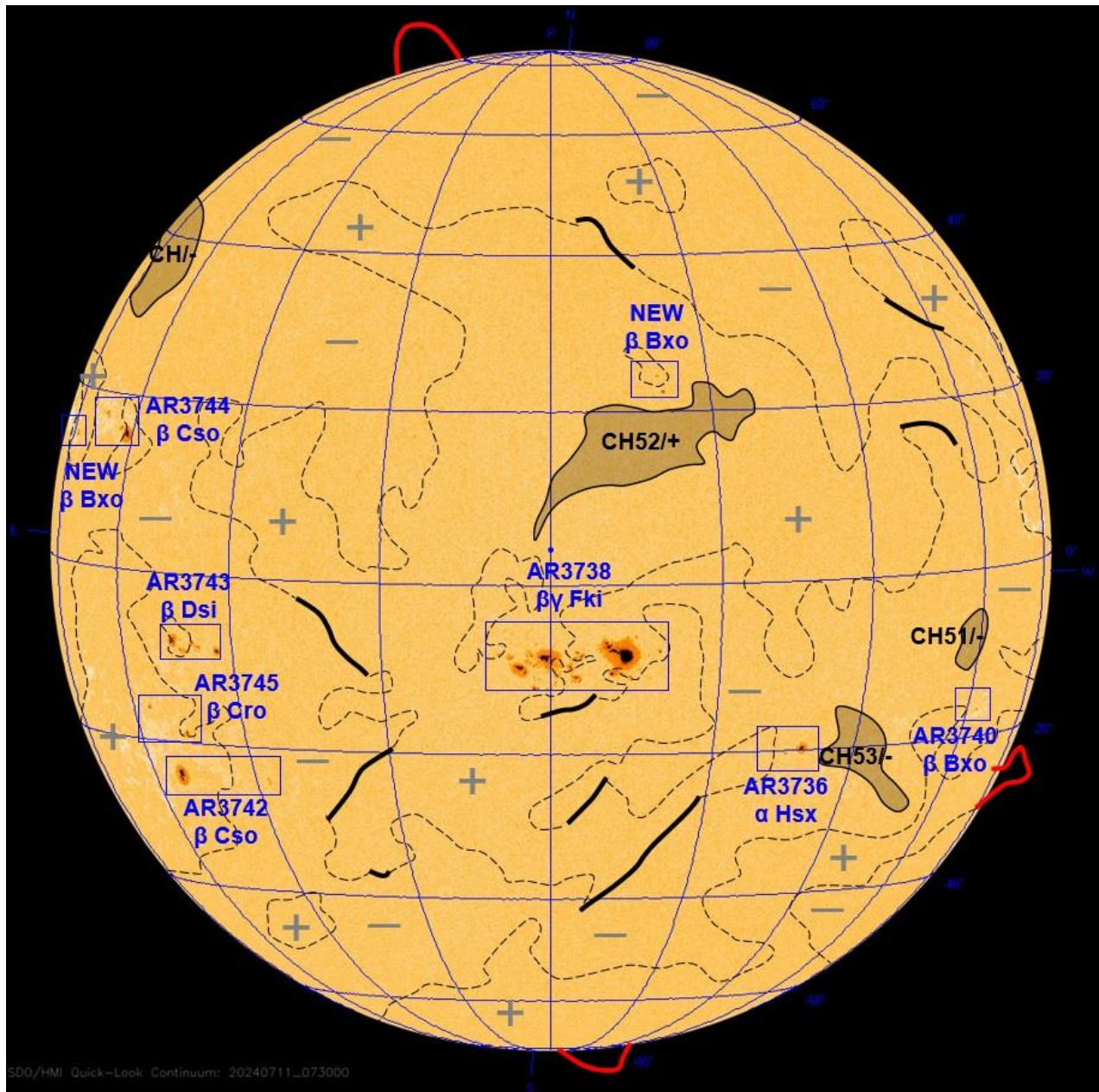
Four-Day Space Weather Forecast Summary

Solar Activity: Mainly Moderate activity is expected with further M-class flares, most likely from AR3738 in the south-centre disc.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Slow wind conditions at first, with a chance of slight enhancement from any fast wind interaction from the southwestern coronal holes CH51/CH53 on day 1 into day 2 (11-12 Jul). A more notable enhancement is then likely on day 3, peaking later in the day or early day 4 (Jul 13-14), due to the onset of the fast winds of CH52. Mainly Quiet geomagnetic activity is expected with Unsettled intervals. Any fast wind enhancement will bring a likelihood of an Active spell, with isolated G1 Minor Storm intervals. These most likely on day 3 (13 Jul).

Energetic Particles / Solar Radiation: High energy proton flux is expected to persist at background, but with a chance of rising in response to any notable flares from AR3738, with a slight chance of approaching the S1 Minor Solar Radiation Storm threshold. High energy electron flux is expected to remain mostly at background, but may respond to any fast wind enhancement, increasing to Moderate with a slight chance of reaching High on day 4 (14 Jul). The associated 24 hour fluence is expected to remain below the Active level.

Figure 1. Solar Analysis Valid 11/0800 UTC.



Key: Filament — , Prominence — , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

There are no Earth-directed CMEs.

Current slow wind conditions, with background speeds are expected to become enhanced later day 1 and into day 2 (11-12 Jul) due to the onset of the fast wind CH51 and CH53 located in the southwest disc. The extent of any enhancement is low confidence with MOSWOC Enlil over-estimating the extent of these features, so currently providing poor guidance. Given their southern location, with Earth now north of the ecliptic plane, and also not being present on the previous rotation, only a minimal connection is anticipated. Slightly elevated solar winds are likely, perhaps increasing geomagnetic activity from initially Quiet to be Unsettle to Active with a slight chance of G1 Minor Storms for a time.

Any enhancement is likely to ease for a time later day 2 and into day 3 (12-13 Jul), before the onset of the next fast wind, from north-centre disc CH52/+. This is a broad positive hole, currently across the north-centre disc, and fast wind onset is most likely to occur through day 3, but likely peaking later in the day or early day 4 (13-14 Jul). This is low confidence, as while the coronal hole did feature on the previous rotation, its appearance and location has changed, and Enlil is also unable to provide good guidance due to the over-estimation of the southwestern coronal holes. However, elevated winds, are likely by the end of day 3 (13 Jul), bringing a potential for a further period of Unsettled to Active geomagnetic activity, with a chance of G1 Minor Storms.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	5	10	30	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2a: SDO aia-211 of previous rotation (left) and current (right).

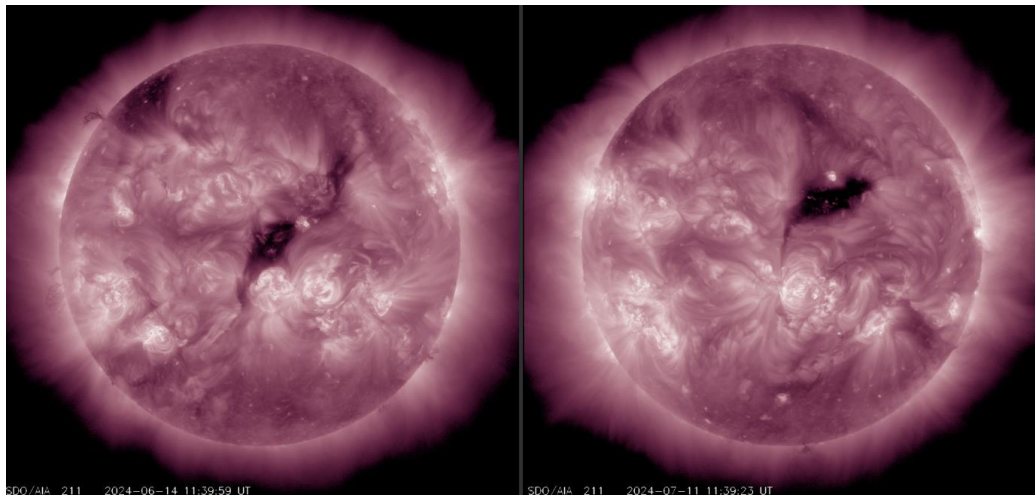
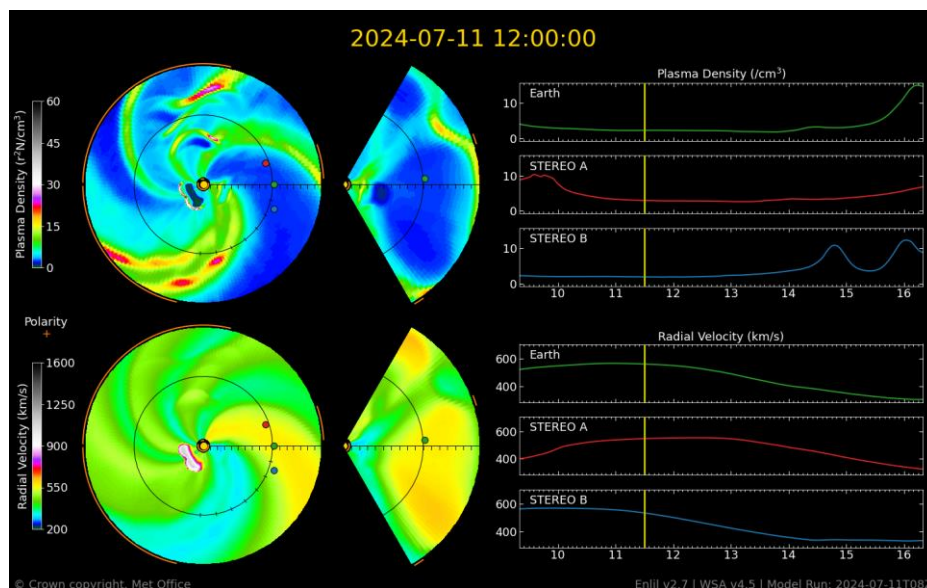


Figure 2b: Enlil showing broad enhancement from southern coronal holes, while the northern coronal hole is expected to be more dominant.



Radio Blackouts - X-Ray Flares:

Activity is expected to be mainly Moderate with further M-class flares expected and a slight chance of isolated X-class flares.

There are nine active regions currently on the visible disc, with the focus of any activity currently from AR3738 in the south-centre disc. This is a large region with some slight complexity, however it has shown signs of maturing with the loss of a small delta spot within its intermediate region, and some spreading between the main leader and trailer. This is expected to continue bringing occasional M-flares, but with this potential reducing later in the period, depending on how the region continues to develop. Of the other regions on the disc, AR3743 in the southeast is the most notable, but remains a simple bipolar group, while all other regions remains smaller and simpler.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	75	75	70	60
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3a: GOES 16/18 X-ray flux Frequent low M-class flares.

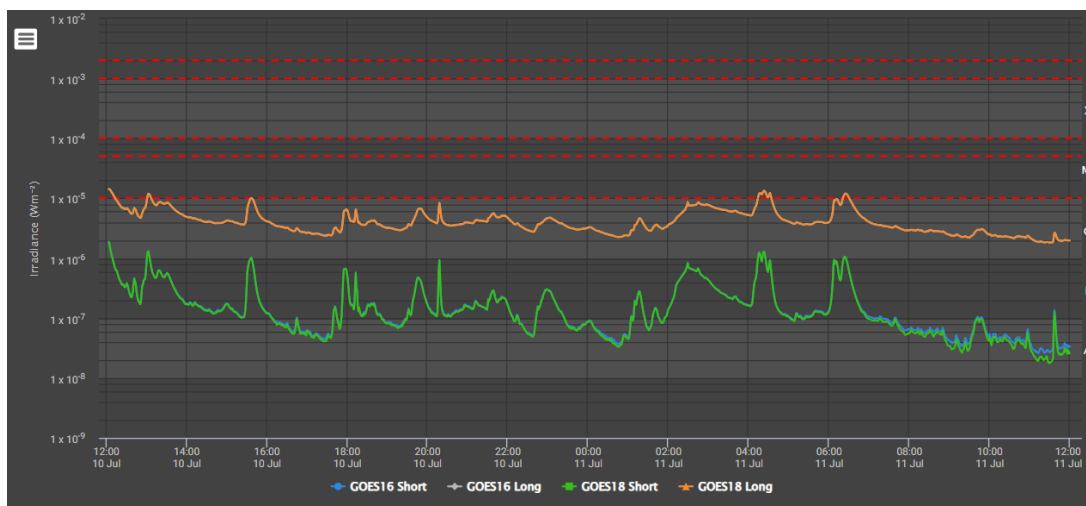
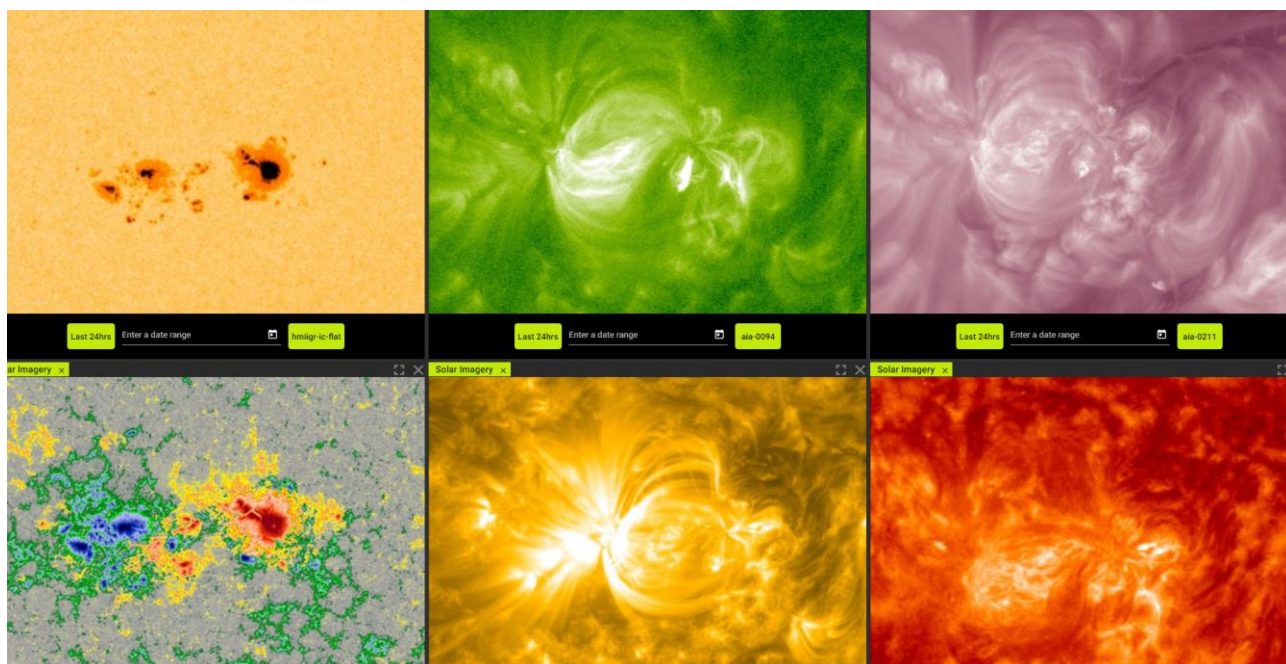


Figure 3b: SDO imagery of AR3738



Solar Radiation Storms - (High Energy Protons):

High energy proton flux at GOES18 is at background levels. It is most likely to remain, but with a slight chance of exceeding the S1/Minor radiation storm threshold should any larger flares occur, mainly from AR3738. As this region rotates towards the southwest, the probability of reaching S1 increases slightly.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	10	10	15	15
Very Active	$\geq \text{S3}$ *	No	1	1	1	1
* $\text{S3} \geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)						

High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy electron flux observed at GOES16 has been at background is expected to persist at this level, until at least day 4 (14 Jul). Any enhancement from the fast wind of CH52 on day 3 (13 Jul) may then allow for an increase to Moderate, perhaps briefly High flux.

The associated electron fluence is forecast to remain below the Active threshold, but with the potential for a rising trend day 4 (14 Jul). MOSWOC REFM is currently giving good guidance, and is expected to remain so until the onset of any fast winds.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	1	1	5
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1